Transaction-Based Control of Workstations

Project Summary
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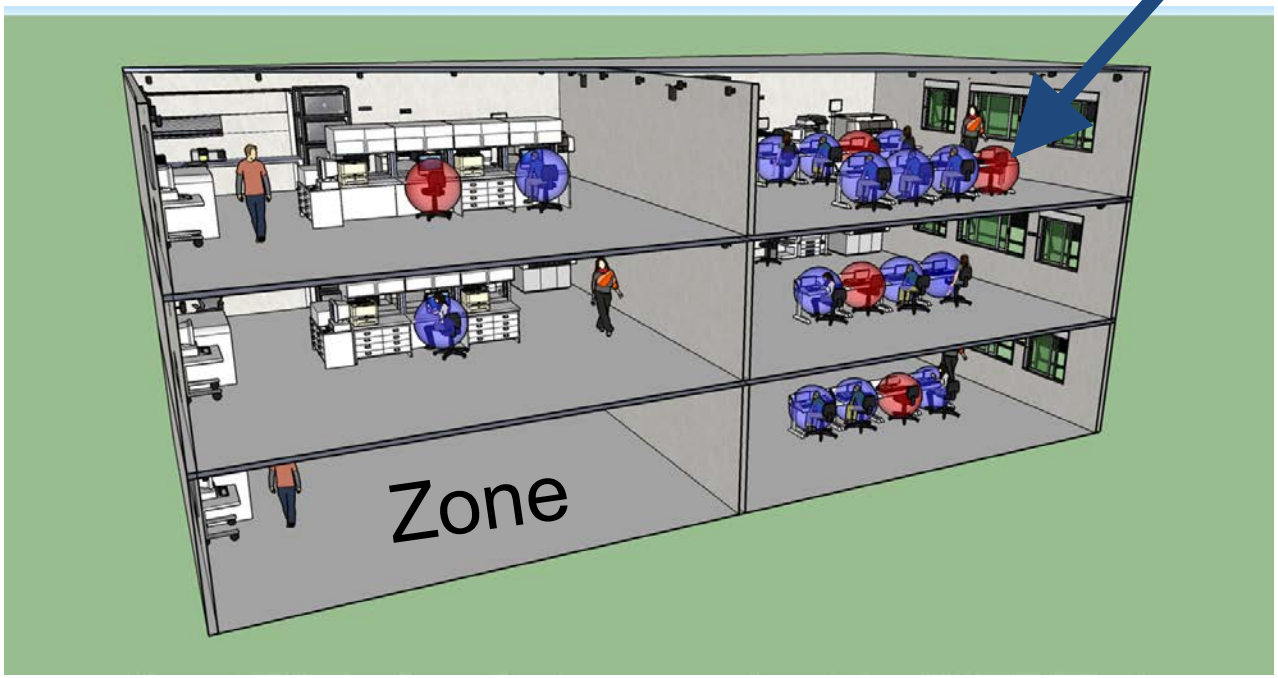
CBERD: Integrated Workstation Control

- Challenge:
  - Manage power use at workstation, zone, and building level, while still giving individual occupants control.
  - Demonstrate that control of many workstation-level loads can noticeably reduce zone power by at least 10%



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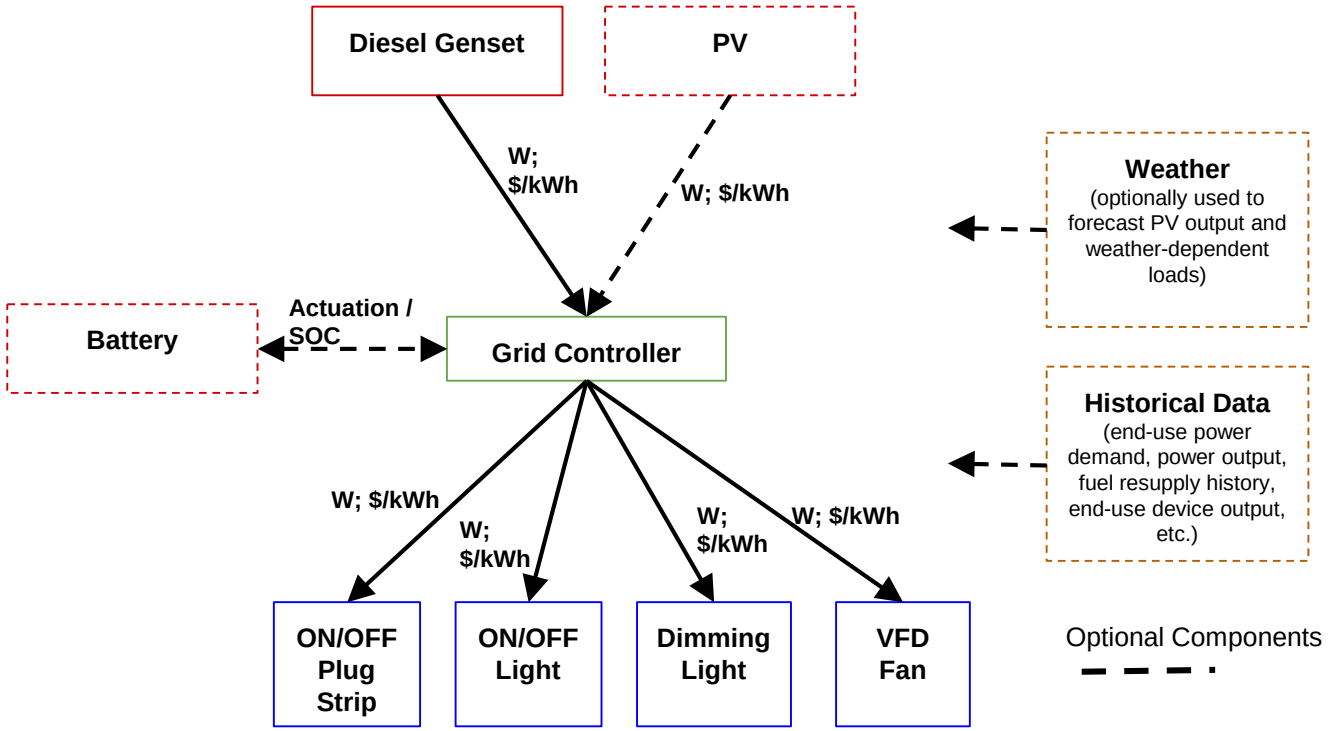
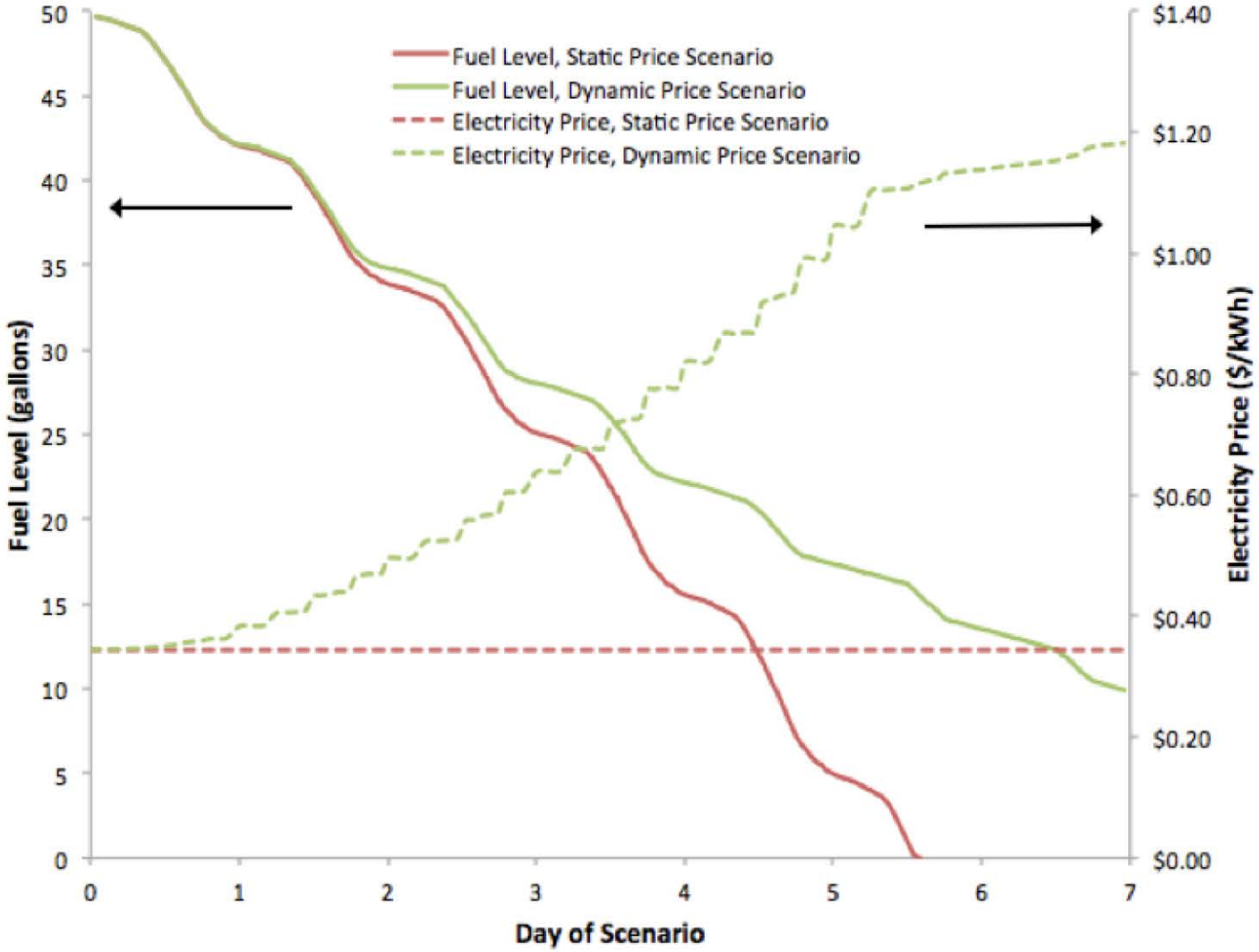
Background: Transactive Microgrid Controller

- Price of electricity used to manage energy, balance supply & demand
- Supply assets (generators, battery) publish prices based on energy scarcity
- Grid controller considers prices from generators, factors in storage, and publishes price for end-use devices to balance available supply and demand
- End-use devices adjust load based on local price and device-specific demand elasticity curves (or "functions" where demand is not continuous)



Example Microgrid Simulation Results



"Fuel level" refers to the remaining fuel in the diesel generator tank.

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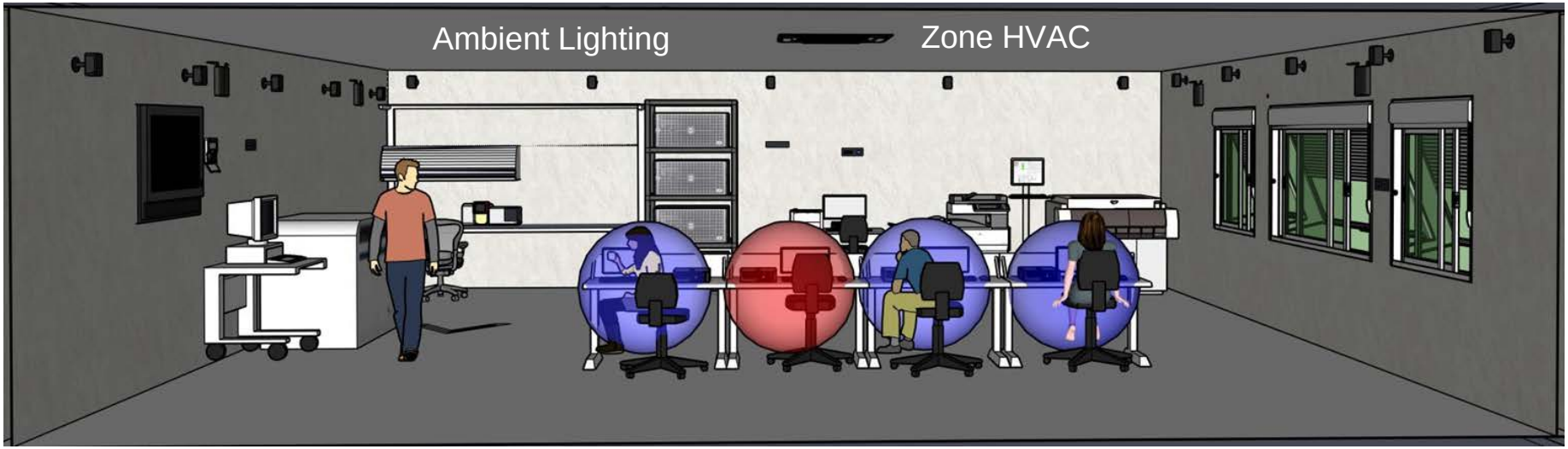
Integrated Workstation Components



Workstation	Zone
- Networked plugstrip (laptop/monitor)	- Zone HVAC
- Personalized fan / radiant cooling/ heating	- Ambient lighting
- Task light	- Shades
- Battery storage	- Battery storage

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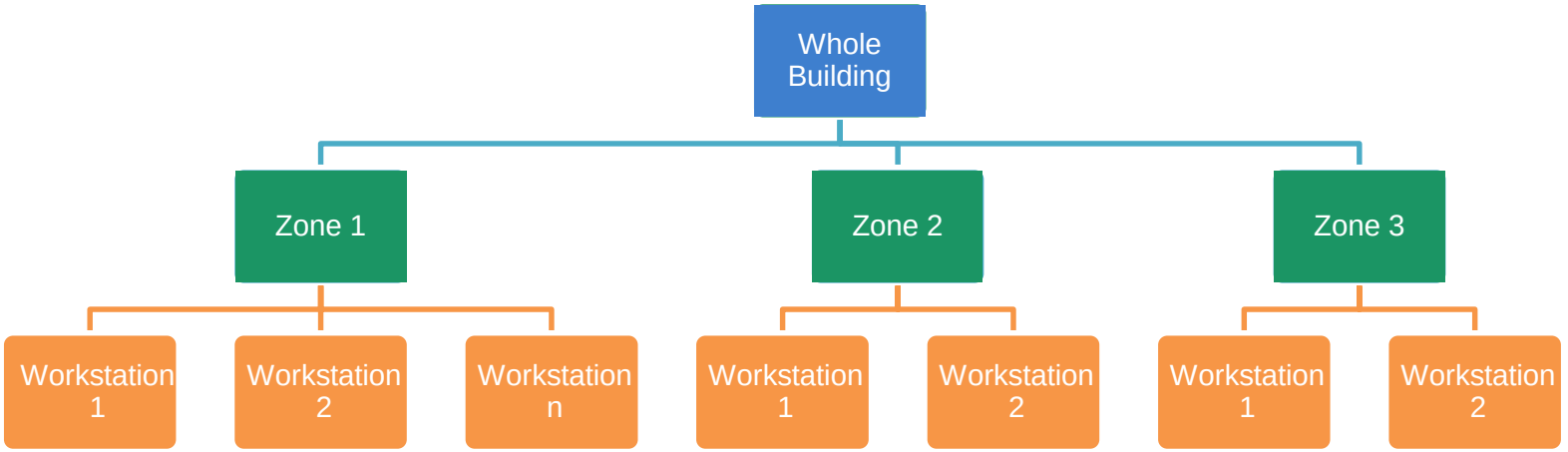
Integrated Workstation Architecture



- Each workstation controlled independently using transactional-energy methods
- VOLTTRON instance in each workstation sets local power price
- Zone-level VOLTTRON instance sets power price to coordinate independent workstations and zone-level assets (lighting zones, VAV boxes, batteries), based on:
  - availability of grid power
  - demand response events
  - local resources (e.g., solar, backup generators, battery storage)

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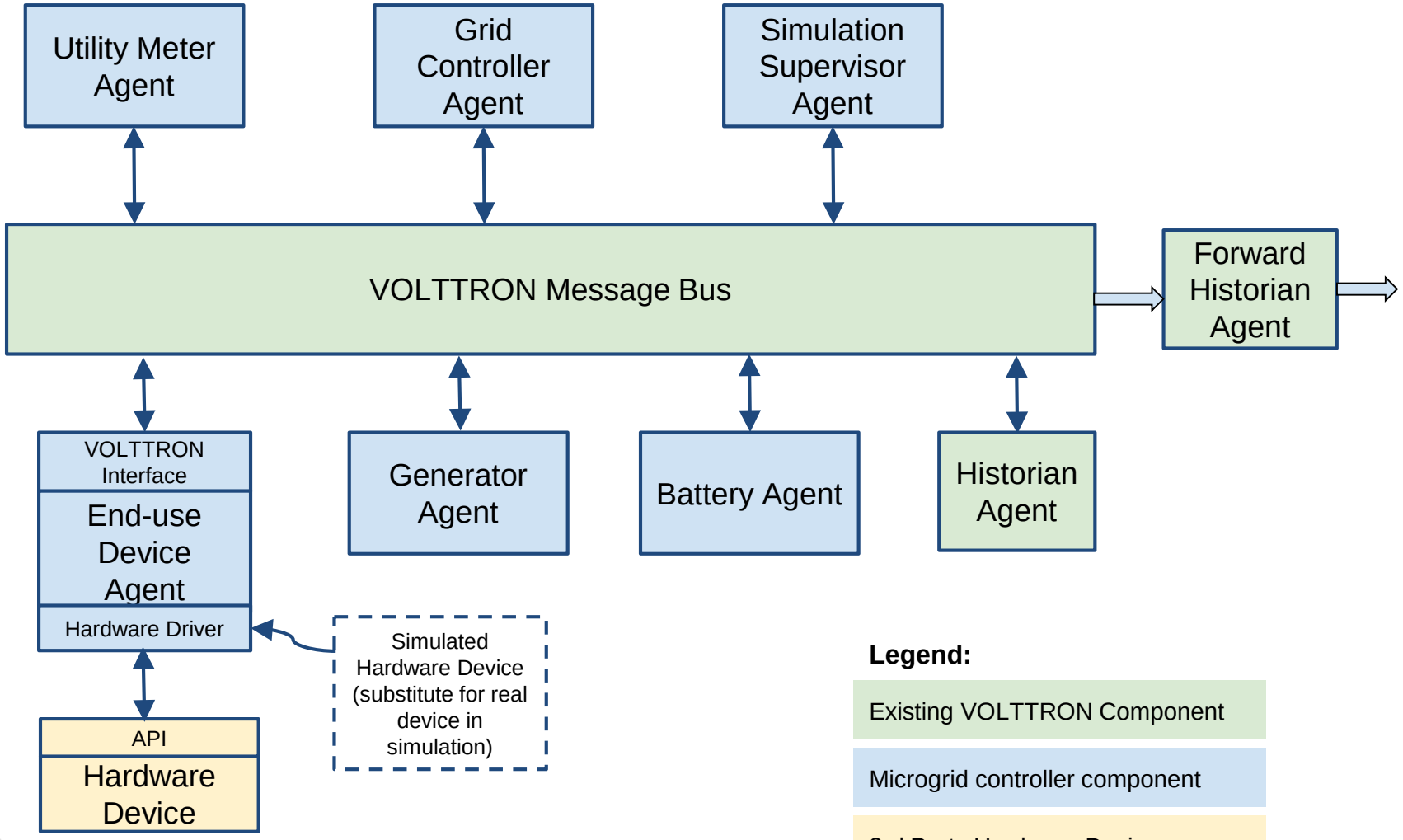
Software Platform Elements



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VOLTTRON Specifics

- All hardware devices represented by an autonomous agent that controls price-responsiveness
- Agents generate events on change of state
  - Power Price
  - Power Consumption
- Events published through topics on message bus
  - Can be global or addressed to specific devices
  - Many events trigger follow-on events
- Historian stores time series data
  - Allows agents to do trending and forecasting
  - Forward historian aggregates workstations to the zone level

VOLTTRON drivers ease integration of hardware devices with message bus

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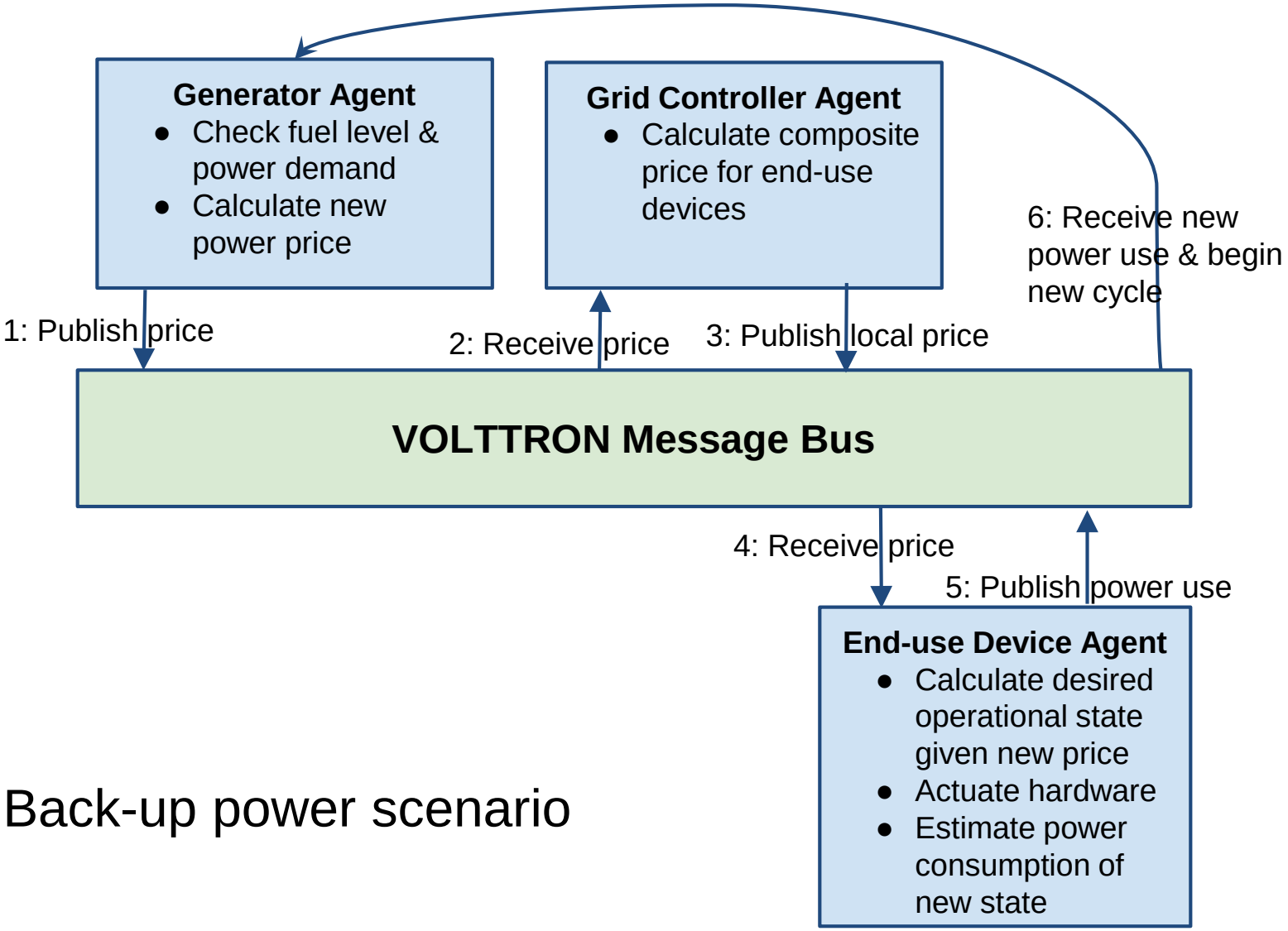
Event Handling Example in VOLTTRON



Back-up power scenario

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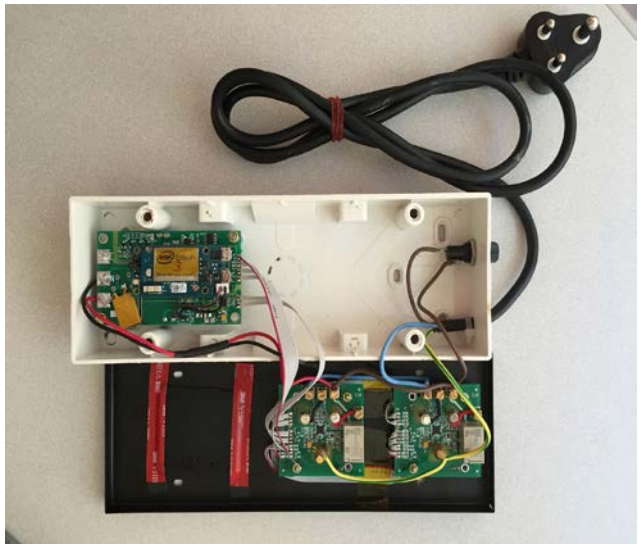
Field Testing

- FY17 field test at IIIT-H and LBNL's FLEXLAB
- ~4 occupied workstations at each site
  - –Smart VOLTTRON-based Plugstrips
  - –Personalized comfort controls
  - –Task lights
- Testing generator scenarios and Demand Response events



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